

A PROCESS FOR CONVERTING COAL INTO FUEL CELL QUALITY
HYDROGEN AND SEQUESTRATION-READY CARBON DIOXIDE

ABSTRACT OF THE DISCLOSURE

[0044] A process for burning coal to produce substantially pure hydrogen for use in fuel cells, together with "sequestration ready" carbon dioxide and a stream of oxygen depleted air for powering gas turbines, characterized by using a combination of two fluidized bed reactors and a third transfer line reactor, the first reactor being supplied with coal particles or "char" and fluidized with high temperature steam; the second reactor being fluidized with high temperature steam and the third reactor being fluidized by compressed air. Solids circulated among these three reactors include a mixture of materials containing calcium compounds (present as CaO , CaCO_3 and mixtures thereof) and iron compounds (present as FeO , Fe_2O_3 and mixtures thereof). The coal is gasified by the steam in the presence of CaO to produce CaCO_3 and relatively pure hydrogen for use in fuel cells per a CO_2 acceptor process. Because only part of the coal char input to the first reactor is gasified to produce hydrogen, the remainder can be burned to supply thermal energy necessary to regenerate the CaCO_3 back to CaO . Carbon in the middle bed fluidized bed reactor reacts with Fe_2O_3 in the third reactor and the temperature in the middle fluidized bed reactor is sufficiently high to decompose CaCO_3 back into CaO .